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## (54) OPTICAL DEVICE

## (57) Abstract:

**PROBLEM TO BE SOLVED:** To obtain a variable focus lens which is of a high speed, has a small aberration and also whose optical characteristics can be changed actively, continuously and periodically by specifying the surface shape or the refractive index distribution of a fixed lens or both of them.

**SOLUTION:** The variable range of a refractive index variable substance 12 is decomposed and, for example,  $\sum \beta_p (\Sigma \alpha_n R_n)_{kkp}$  are calculated by applying a weight  $\beta_p$  (which depends on importance at the time of using refractive indexes) to the sum of aberrations  $(\Sigma \alpha_n R_n)_{kkp}$  with respect to the refractive indexes  $K_p (p=1, 2, \dots)$ . The surface shape or the refractive index distribution of a fixed lens 11 or both of them is searched. Then, a solution capable of making aberrations minimum even when the refractive indexes are changed is found by performing this design. Thus, the aberration is made small in the whole of the refractive index variable range of the refractive variable substance 12. Moreover, importance of a focal length (which is determined by the refractive index) can be considered. Furthermore, when the design is executed by changing not only the surface shape of the fixed lens 11 but also the refractive index distribution of the lens, the number of changing parameters is increased to make the aberration smaller.

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